OPERATOR'S MANUAL

MODEL 266
VACUUM TUBE VOLTMETER

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Figure 1 Simpson Model 266 Vacuum Tube Voltmeter
Size: 8½" x 9½" x 8". Weight: 8 lbs.

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Foreword

The Simpson Model 266 vacuum tube voltmeter is a necessity for modern servicing of FM and television receivers.

You will find in the Model 266 features that lift it far out of the class of ordinary vacuum tube voltmeters. Such a feature is the 1 volt range, for full scale deflection, necessary in low R. F. voltage measurements. Another is the zero center switch provided for discriminator circuit alignment, a feature which embraces all D. C. voltage ranges.

D. C. volt input resistance ranges from 50 megohms to 200 megohms; A. C. volt input impedance at 60 cycles is 40 megohms. In dealing with the high frequencies encountered in FM and television receiver servicing, the low input capacitance of the probe (approximately 4 micro-microfarads) is important for the essential accuracy it provides.

Model 266 combines exceptional instrument beauty with durable construction. The fine cabinet-making, the shining silver and black panel of enduring anodized aluminum, the convenient well for holding the AC probe—all these are typical Simpson engineering refinements.

Like all Simpson instruments, Model 266 is made almost entirely within the various plants of the Company. Practically all component parts have been designed, tooled and manufactured by us. This is not an assembly job made up from purchased parts as is true of the majority of testers on the market.

We are by far more self-contained than any other manufacturer of test equipment. This is your assurance that the tester we offer will not quickly become obsolete. Our tremendous investment in expensive production tools is your safeguard against obsolescence and further assurance of unvarying quality.

Here at Simpson we do not think of making instruments merely to *sell*. We think of making instruments to *serve*. Our interest in your Model 266 and in your satisfaction with it never ceases. That is the reason for this Operator's Manual. We want you to know how to get the most from your 266.

We have made Model 266 as sturdy as we know how. We urge you, however, to treat it with care, as its mechanism is actually more delicate than that of a fine watch. Keep it clean, free from continuous, severe vibration. Do not let it be dropped or roughly handled and it will give you many, many years of accurate, dependable service.

OPERATOR'S MANUAL

SIMPSON MODEL 266 VACUUM TUBE VOLTMETER

SECTION I

GENERAL DESCRIPTION

1. INTRODUCTION

The Simpson Model 266 Vacuum Tube Voltmeter, as shown in Figure 1, offers the service dealer and technician a test unit of wide use with an unusually high input resistance. In fact, its use is a necessity in modern servicing of FM and television receivers.

The sloping panel with compact, convenient arrangement of controls and large four and one-half inch meter provides greatest ease in taking readings. The lustrous anodized aluminum panel and handsome case add a professional appearance to any shop. A door in the back of the case permits access to a compartment for storing line cord, test leads, and probes when not in use.

The 266 is supplied with a set of standard test leads with alligator clips, a DC test probe, and an AC test probe. The DC test probe is insulated for use up to 1000 volts and, if desired, an alligator clip may be slipped over its end. The AC probe can be used up to 250 volts, being limited by the 9006 tube housed in the probe. Voltage regulation over a range of 105 to 125 volts is provided by a 2A12 regulator tube connected in the primary circuit of the power transformer. The internal battery used for resistance measurements has a long shelf life and will seldom need to be replaced.

A zero center switch is provided for discriminator circuit alignment, the scale being calibrated in arbitrary divisions of 1 to 5 each side of center. Any DC range may be used, the right side of the scale indicating positive voltage up to one-half of the range being used and the left side indicating negative voltage up to one-half of the range.

The standard model is designed for operation on 115 volt, 60 cycle current. Accuracy is 3% DC and 5% AC (60 cycles) of full scale deflection. Response is practically uniform from 30 cycles to 130 megacycles. The input capacitance of the

AC probe is approximately 4 micro-microfarads, shunted by 40 megohms at 60 cycles.

2. MEASUREMENT RANGES AVAILABLE

a. VOLTAGE DC—Constant Input Resistance of 50 Megohms

0-1 volt
0-5 volts
0-10 volts
0-50 volts
0-100 volts
0-250 volts
0-500 volts
0-1000 volts
} with DC probe

0-5000 volts with test leads

b. VOLTAGE AC

0-1 volt
0-5 volts
0-10 volts
0-50 volts
0-100 volts
0-250 volts
} with AC probe or test leads

0-500 volts
0-1000 volts
0-5000 volts
} with test leads

c. CURRENT DC

0-1 milliampere	200 millivolts
0-5 milliamperes	240 millivolts
0-10 milliamperes	245 millivolts
0-50 milliamperes	249 millivolts
0-100 milliamperes	249.5 millivolts
0-250 milliamperes	249.8 millivolts
0-500 milliamperes	249.9 millivolts
0-10 amperes	250 millivolts

d. RESISTANCE DC

0-1000 ohms	10 ohms center
0-10,000 ohms	100 ohms center
0-100,000 ohms	1000 ohms center
0-1 megohm	10,000 ohms center
0-10 megohms	100,000 ohms center
0-100 megohms	1 megohm center
0-1000 megohms	10 megohms center

3. VOLTAGE MEASUREMENTS DC

DC voltage is measured by applying the voltage through a voltage divider to the grid of one section of a 6SN7 tube. This causes an unbalanced condition between the two sections of the tube, resulting in an indication on the meter proportional to the voltage applied.

4. VOLTAGE MEASUREMENTS AC

AC voltage is measured by applying the voltage to the grid of the 9006 tube housed in the AC probe where it is rectified and then measured the same as DC. AC voltages under 250 are applied directly to the probe while those over 250 pass through a voltage divider first.

5. CURRENT DC

Current in DC circuits is measured by connecting the meter, with suitable internal shunts, in series with the circuit being checked. Maximum current in each range results in full scale deflection.

6. RESISTANCE DC

DC resistance is measured by applying a voltage from an internal battery proportional to the value of the resistance being measured to the grid of one section of a 6SN7 tube. This causes an unbalanced condition between the sections of the tube resulting in a deflection of the meter proportional to the resistance being measured.

SECTION II

OPERATING INSTRUCTIONS

CAUTION: When making measurements with test leads, turn off the power to the circuit under test, clip the test leads to the desired points and then turn on the power to take the reading. Turn off the power to disconnect the meter. When using the DC or AC probe, turn off the power to clip the ground lead to the chassis or one side of the circuit and

turn on the power to take the reading, holding the probe on the point to be checked. To avoid possible shock when using probes, keep the free hand away from the chassis or any part of the circuit.

ZERO ADJUSTMENT (mechanical): Before turning on the power to the Model 266, be sure that the pointer is on zero. If pointer is off zero, adjust by means of the slotted screw located in the bakelite case directly below the meter scale. Use a small screw-driver to turn this adjustment slowly right or left until the pointer is directly over the zero point on the scale.

1. OPERATION OF CONTROLS

a. CIRCUIT SELECTOR SWITCH.

When the circuit selector switch (directly above "DC PROBE") is in the "OFF" position, the power is turned off. Turning this switch to the right turns on the power and also selects the circuit to be used. The two positions marked "+DC V" and "—DC V" constitute a meter reversing switch which makes it convenient to clip the common lead to the chassis or other convenient point and to check voltages at various points in the circuit, changing the switch to correspond to the polarity of the voltage.

b. RANGE SELECTOR SWITCH

The range selector switch (directly above "AC PROBE") selects the desired range for the circuit indicated by the position of the circuit selector switch.

c. ZERO ADJUSTMENT (electrical)

After the power has been turned on and the circuit selector switch placed in one of the voltage measuring positions, the knob marked "ZERO ADJ" just to the left of the meter should be turned to the right or left until the pointer is directly over the zero point on the scale. When making this adjustment, the DC probe should be plugged into the "DC PROBE" receptacle and the tip of the probe inserted into the "COMMON" jack. When changing ranges, it may be necessary to readjust zero.

d. OHMS ADJUSTMENT

With the circuit selector switch placed in the "OHMS" position and the range selector switch in one of the resistance measuring positions, the pointer will rest near the right end of the scale (without test leads shorted). The knob just to the right of the meter marked "OHMS ADJ" should be turned right or left until the pointer is directly over the mark at the right end of the scale, the point of infinite resistance.

2. VOLTAGE MEASUREMENTS 0 to 1000 VOLTS DC

a. Place the circuit selector switch in the "+DC V" position.

b. Rotate the range selector switch to any one of the eight voltage positions (1 to 1000V) required. While the 266 will not be damaged easily, select a range higher than the voltage to be measured. After the first reading, the switch can be reset to a lower range, if needed, to get a more accurate reading.

c. Plug the black test lead into the jack marked "COMMON" and clip the other end to the common side of the circuit to be checked. Plug the DC probe into the receptacle marked "DC PROBE."

d. Turn on the power to the circuit under test and place the end of the probe on the point to be checked. If desired, an alligator clip may be slipped over the end of the probe and clipped to the point to be checked before the power is turned on. If the meter deflects to the left of zero, the polarity is incorrect and the circuit selector switch may be placed in the "—DC V" position which reverses the meter or the position of the test leads may be reversed.

e. Read the voltage on the black arc second from the top marked "VOLTS-AMPERES-MA" reading the figures as follows:

1 volt range—read 0-10 and divide by 10
5 volt range—read 0-50 and divide by 10
10 volt range—read 0-10 directly
100 volt range—read 0-10 and multiply by 10
250 volt range—read 0-250 directly
500 volt range—read 0-50 and multiply by 10
1000 volt range—read 0-10 and multiply by 100

3. ZERO CENTER DC VOLTS

a. Place the circuit selector switch in the position marked "ZERO CENTER." Adjust zero as described in paragraph 1c.

b. Rotate the range selector switch to a range at least twice the probable voltage to be measured and make connections as for DC volts.

c. For voltages up to 1000V, use the DC probe as described in paragraph 2c. For the 5000V range, use the test leads as described in paragraph 4.

d. Observe the indication on the bottom arc of the scale marked "ZERO CENTER DC VOLTS." Positive voltage will be indicated to the right of center and negative voltage to the left of center, the scale being calibrated in arbitrary divisions numbered 1 to 5 each side. Each side represents one-half of the range being used. For example, when the 100 volt range is being used, each half of the scale represents 50 volts and each division 10 volts. However, the purposes for which the zero center scale is used usually do not require an accurate measurement of voltage but merely an indication of a balanced condition. Such a use is illustrated by a discriminator where a balanced condition will result in a zero center indication while an unbalanced condition will cause either a positive or negative deflection.

4. VOLTAGE MEASUREMENTS 1000 to 5000 DC VOLTS (with test leads)

CAUTION: Use extreme care when checking high voltage. Always turn off power when making connections and do not touch leads or meter while taking readings. Turn off power before disconnecting leads.

a. Place the circuit selector switch in the "+DC V" position.

b. Set the range selector switch in the "5000 V" position.

c. Plug the black test lead into the jack marked "COMMON" and the red test lead into the jack marked "5000 V DC."

d. Be sure power is turned off to the circuit under test and condensers discharged and then clip the black lead to the common side and the red lead to the high potential side of the circuit.

e. Turn on the power. If the pointer deflects to the left of zero, place the circuit selector switch in the "—DC V" position.

f. Read the voltage on the second black arc from the top using the figures 0-50 and multiplying by 100.

5. VOLTAGE MEASUREMENTS 0 to 250 AC VOLTS

With AC probe—use for all RF and high frequency measurements.

CAUTION: Do not measure voltage higher than 250 with the AC probe as the 9006 tube in the probe may be damaged.

a. Place the circuit selector switch in the position marked "AC V."

b. Rotate the range selector switch to any one of the six voltage positions required from 1V to 250V.

c. Plug the AC probe lead into the socket marked "AC PROBE." Clip the ground lead from the probe shell to the chassis or ground side of the circuit to be measured.

d. Turn on the power to the circuit under test and hold the point of the probe against the point to be checked. To avoid accidental shock, keep the free hand away from the chassis and any part of the circuit.

e. For the 1 volt range read the voltage on the red arc second from the bottom marked "1V AC ONLY," reading the figures directly.

For the other ranges use the black arc second from the top, reading the figures as follows:

5 volt range—read 0-50 and divide by 10
10 volt range—read 0-10 directly
50 volt range—read 0-50 directly
100 volt range—read 0-10 and multiply by 10
250 volt range—read 0-250 directly

Note—when using the AC probe for low frequency AC voltage measurements, the common connection can be made by means of a test lead connected between the "COMMON" jack and the common side of the circuit being checked. Thus the ground clip on the AC probe is not used, leaving the probe free to be moved more easily. If desired, the AC probe may be placed in the probe well and test leads used for any voltage range.

6. VOLTAGE MEASUREMENTS 0 to 1000 AC VOLTS

With test leads—use for low frequency measurements.

a. Place the circuit selector switch in the position marked "AC V."

b. Rotate the range selector switch to any one of the eight ranges required (1 to 1000V).

c. Plug the AC probe lead into the receptacle marked "AC PROBE" and place the probe in the probe well. Plug the test leads into the jacks marked "COMMON" and "AC VOLTS" and clip the other ends of the leads across the circuit to be measured. AC voltage will read correctly regardless of which way the leads are connected.

d. Turn on the power to the circuit to be tested.

e. For the 1 volt range use the red arc second from the bottom marked "1V AC ONLY," reading the figures directly.

For the other ranges use the black arc second from the top, reading the figures as follows:

0-5 volt range—read 0-50 and divide by 10
0-10 volt range—read 0-10 directly
0-50 volt range—read 0-50 directly
0-100 volt range—read 0-10 and multiply by 10
0-250 volt range—read 0-250 directly
0-500 volt range—read 0-50 and multiply by 10
0-1000 volt range—read 0-10 and multiply by 100

7. VOLTAGE MEASUREMENTS 1000 to 5000 AC VOLTS

CAUTION: Use extreme care when checking high voltage. Always turn off power before making connections and do not touch meter or test leads while taking the reading.

a. Place the circuit selector switch in the position marked "AC V."

b. Rotate the range selector switch to the "5000V" position.

c. Plug the AC probe lead into the receptacle marked "AC PROBE" and place the probe in the probe well. Plug the test leads into the jacks marked "COMMON" and "5000 V AC."

d. Be sure current to the circuit under test is turned off and condensers discharged, then clip the other ends of the test leads across the circuit to be measured. AC voltage will read correctly regardless of which way the leads are connected.

e. Turn on the power to the circuit to be checked.

f. Read the voltage using the black arc second from the top, using the figures 0-50 and multiplying by 100.

8. CURRENT MEASUREMENTS DC MILLIAMPERES AND AMPERES

a. Place the circuit selector switch in the position marked "DC-MA-AMPS." When in this position, the "COMMON" jack is disconnected from the metal panel and chassis of the 266. This permits inserting the leads in the high potential side of a circuit without the panel and chassis being "hot." It is not necessary to have the 266 plugged into the AC line.

b. Rotate the range selector switch to any one of the seven ranges required (1-500 MA). WHEN IN DOUBT OF THE CURRENT PRESENT, ALWAYS USE THE HIGHEST RANGE AS A PROTECTION TO THE METER. After the first reading, the switch may be reset to a lower range for a more accurate reading, if needed.

c. Plug the black test lead into the jack marked "COMMON" and the red test lead into the jack marked "+MA DC."

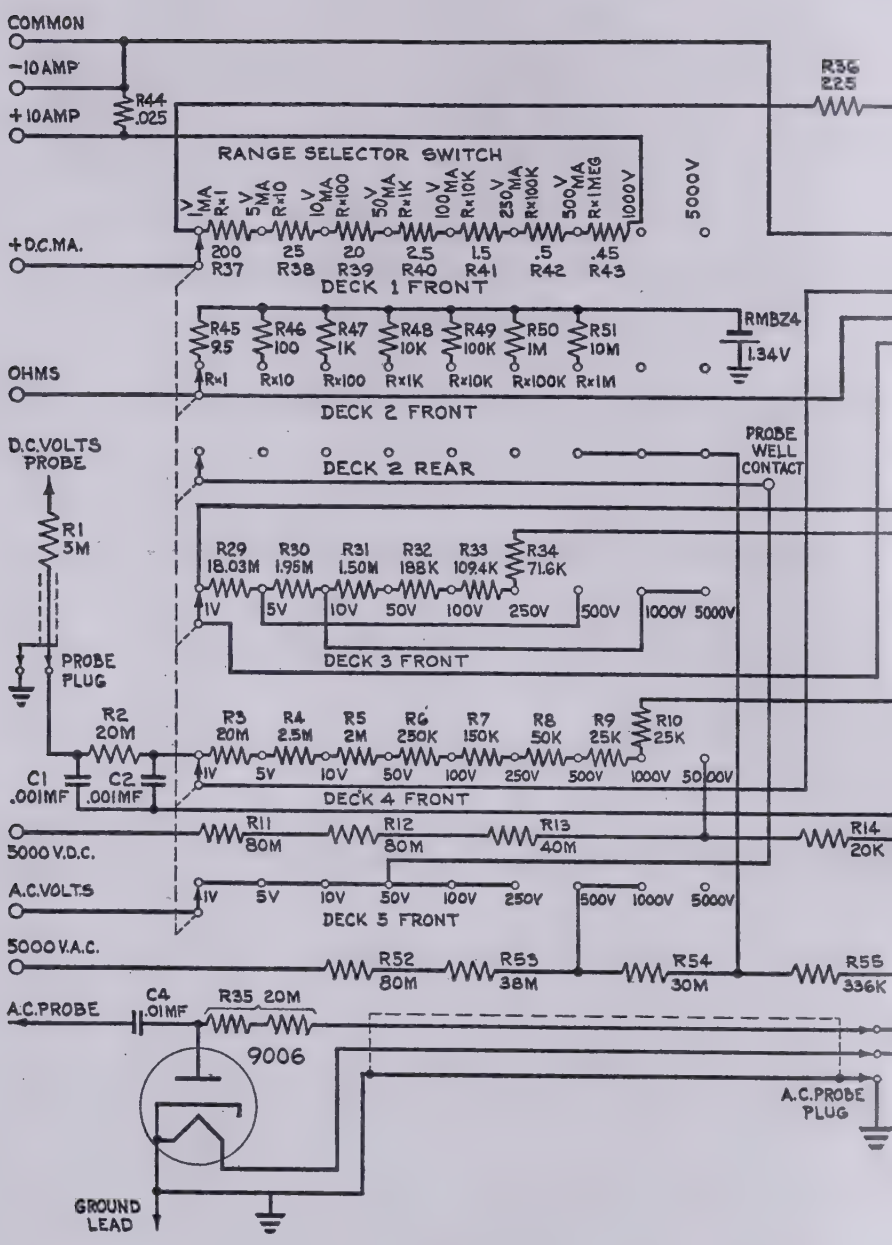
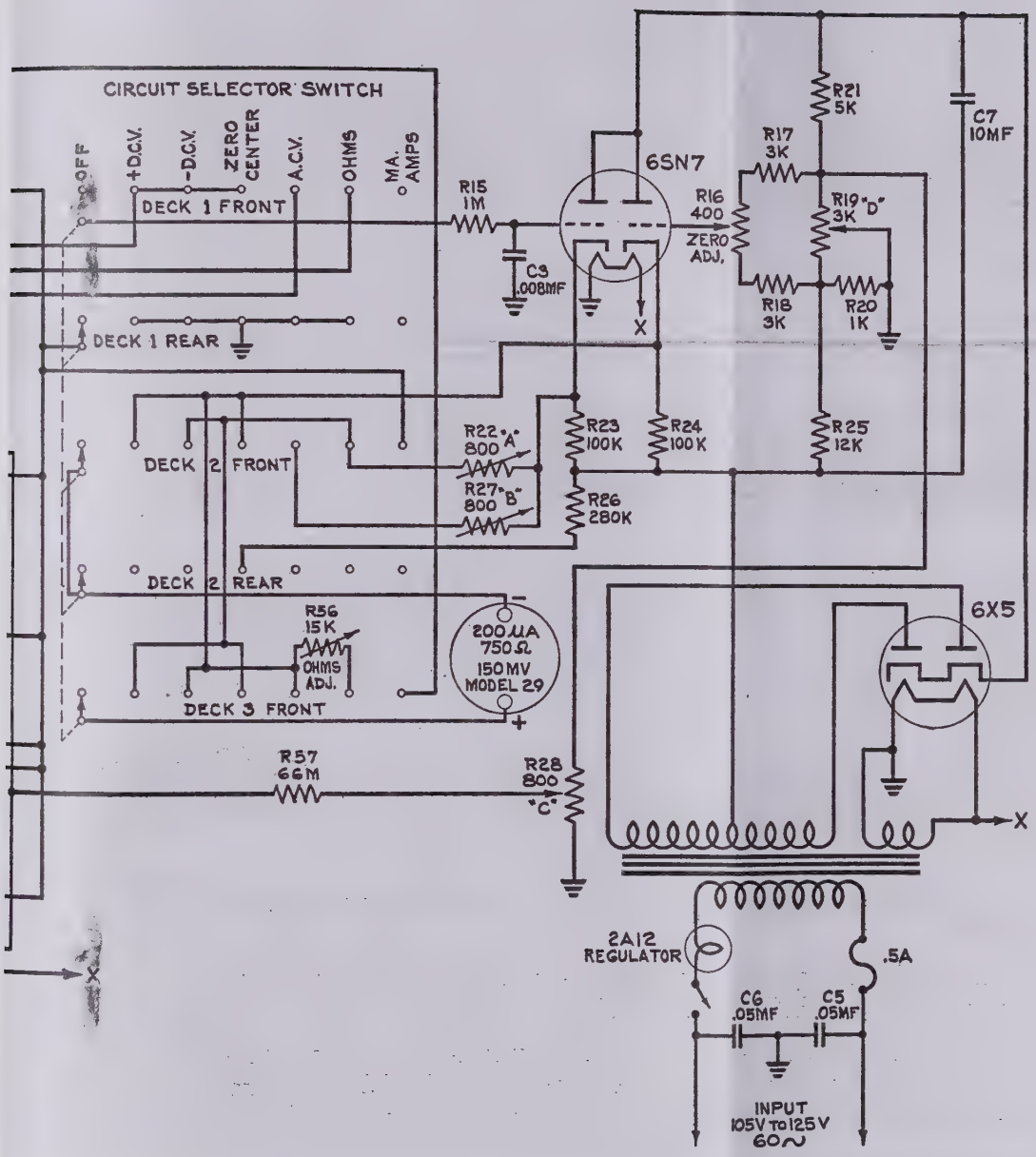

COMMON
-10AMP
+10AMP
R44
.025
R36
225
RANGE SELECTOR SWITCH
1V 1MA R×1
5V 5MA R×10
10V 10MA R×100
50V 50MA R×1K
100V 100MA R×10K
250V 250MA R×100K
500V 500MA R×1MEG
1000V
5000V
+D.C.MA.
200 R37
25 R38
20 R39
2.5 R40
1.5 R41
.5 R42
.45 R43
DECK 1 FRONT
R45 9.5
R46 100
R47 1K
R48 10K
R49 100K
R50 1M
R51 10M
RMBZ4
1.34V
OHMS
R×1
R×10
R×100
R×1K
R×10K
R×100K
R×1M
DECK 2 FRONT
D.C.VOLTS PROBE
DECK 2 REAR
PROBE WELL CONTACT
R1
5M
R29 18.03M
R30 1.95M
R31 1.50M
R32 188K
R33 109.4K
R34 71.6K
1V
5V
10V
50V
100V
250V
500V
1000V
5000V
DECK 3 FRONT
PROBE PLUG
R2
20M
R3 20M
R4 2.5M
R5 2M
R6 250K
R7 150K
R8 50K
R9 25K
R10 25K
C1 .001MF
C2 .001MF
1V
5V
10V
50V
100V
250V
500V
1000V
5000V
DECK 4 FRONT
5000 V.D.C.
R11 80M
R12 80M
R13 40M
R14 20K
A.C.VOLTS
1V
5V
10V
50V
100V
250V
500V
1000V
5000V
DECK 5 FRONT
5000 V.A.C.
R52 80M
R53 38M
R54 30M
R55 336K
A.C.PROBE
C4 .01MF
R35 20M
9006
A.C.PROBE PLUG
GROUND LEAD

Figure 2



Model 266 Schematic Diagram

d. Break the circuit to be tested and insert the meter in series by connecting the red lead to the positive side and the black lead to the other side.

e. Turn on the power to the circuit under test.

f. Read milliamperes on the black arc second from the top.

If pointer deflects to the left of zero, the connections are incorrect. Turn off the power and reverse the position of the test clips.

Read the figures as follows:

1 milliampere range—read 0-10 and divide by 10
5 milliampere range—read 0-50 and divide by 10
10 milliampere range—read 0-10 directly
50 milliampere range—read 0-50 directly
100 milliampere range—read 0-10 and multiply by 10
250 milliampere range—read 0-250 directly
500 milliampere range—read 0-50 and multiply by 10

g. For the 10 AMP range, plug the black test lead into the jack marked "—10 AMP" and the red test lead into the jack marked "+10 AMP." Proceed as above for milliamperes except that the position of the range selector switch may be disregarded.

Read AMPS on the black arc second from the top, reading the figures 0-10 directly.

9. RESISTANCE MEASUREMENTS DC

a. Place the circuit selector switch in the position marked "OHMS."

b. Rotate the range selector switch to any one of the seven ranges required (RX1 to RX1MEG).

c. The pointer will rest near the right end of the scale (without test leads shorted). Adjust "OHMS ADJ" control until meter pointer is directly over the point of infinity (mark at right end of scale). With leads shorted, meter should read zero (left end of scale). It may be necessary to adjust the "ZERO ADJ" knob with leads shorted after which the point of infinity should be rechecked with the test leads open.

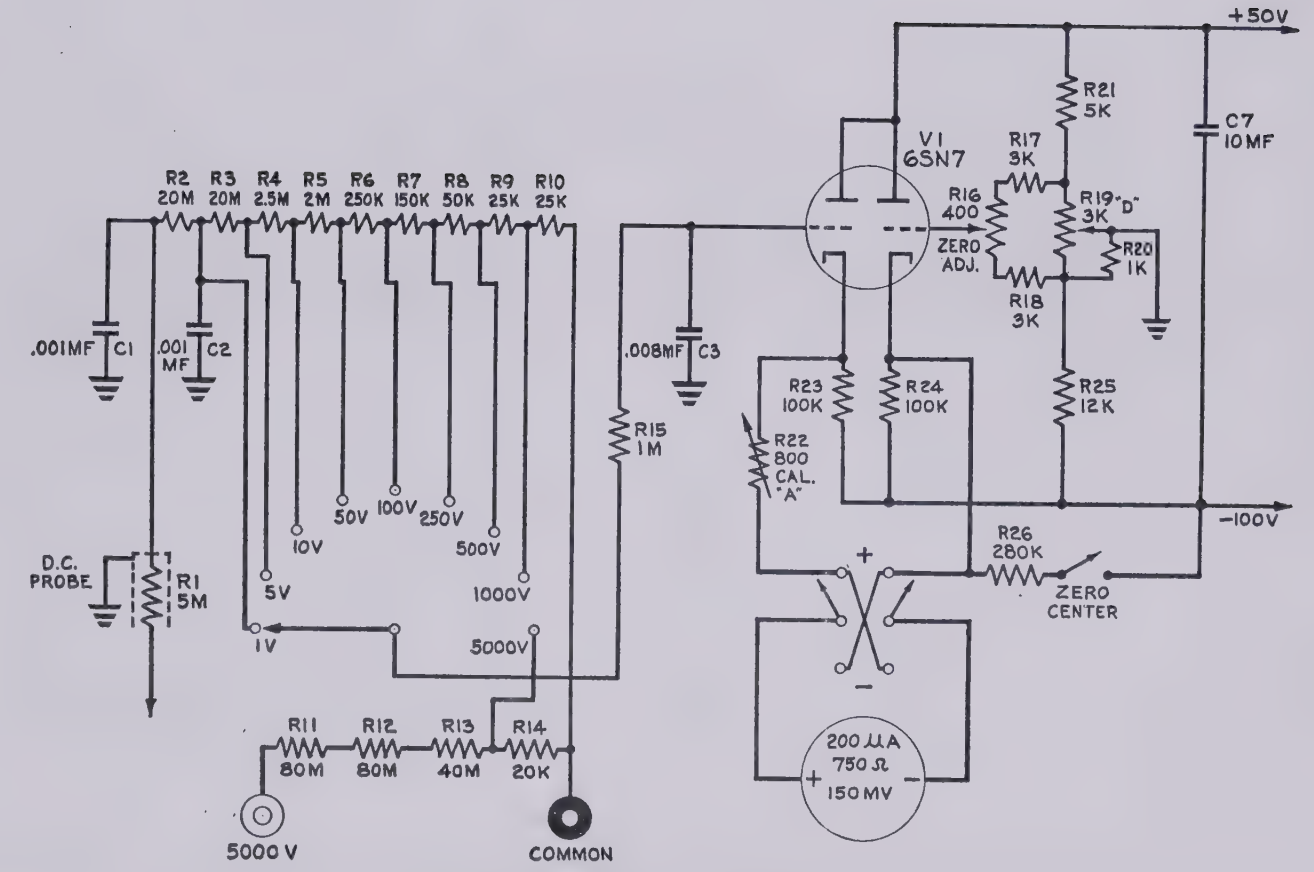


Figure 3 Simplified DC Voltmeter Circuit

d. Plug the test leads into the jacks marked "COMMON" and "OHMS" and clip the other ends across the resistance to be measured.

e. Read ohms on the top arc of the scale marked "OHMS."

Read the figures as follows:

RX1	(1000 ohms) range—read 0-1000 directly
RX10	(10,000 ohms) range—multiply by 10
RX100	(100,000 ohms) range—multiply by 100
RX1K	(1,000,000 ohms) range—multiply by 1000
RX10K	(10,000,000 ohms) range—multiply by 10,000
RX100K	(100,000,000 ohms) range—multiply by 100,000
RX1 meg	(1,000,000,000 ohms) range—multiply by 1,000,000

SECTION III

FUNCTIONING OF PARTS

The complete schematic diagram of the Model 266 is shown in Figure 2. The simplified sections are described in the following paragraphs.

1. DC VOLTMETER

Figure 3 shows a simplified diagram of the circuit used for measuring DC voltage with the circuit selector in the "+DC" position and the range selector in the 1V position.

The DC probe contains the isolation resistor R1. Condensers C1 and C2 with resistor R2 form a filter to prevent stray AC in the circuit being checked from reaching the grid of tube V1.

The voltage being measured is applied across the voltage divider consisting of resistors R1 to R10, having an effective resistance of 50 megohms. This input resistance is constant for all ranges, except 5000 volts when it is 200 megohms. The voltage divider is arranged in such a way that the voltage at the grid of tube VI remains the same for full scale deflection regardless of the position of the range selector. Voltages between 1000 and 5000 are measured with test leads, using the special jack marked "5000 V DC." Resistors R11, R12, R13, and R14 form the voltage divider for the 5000 volt range.

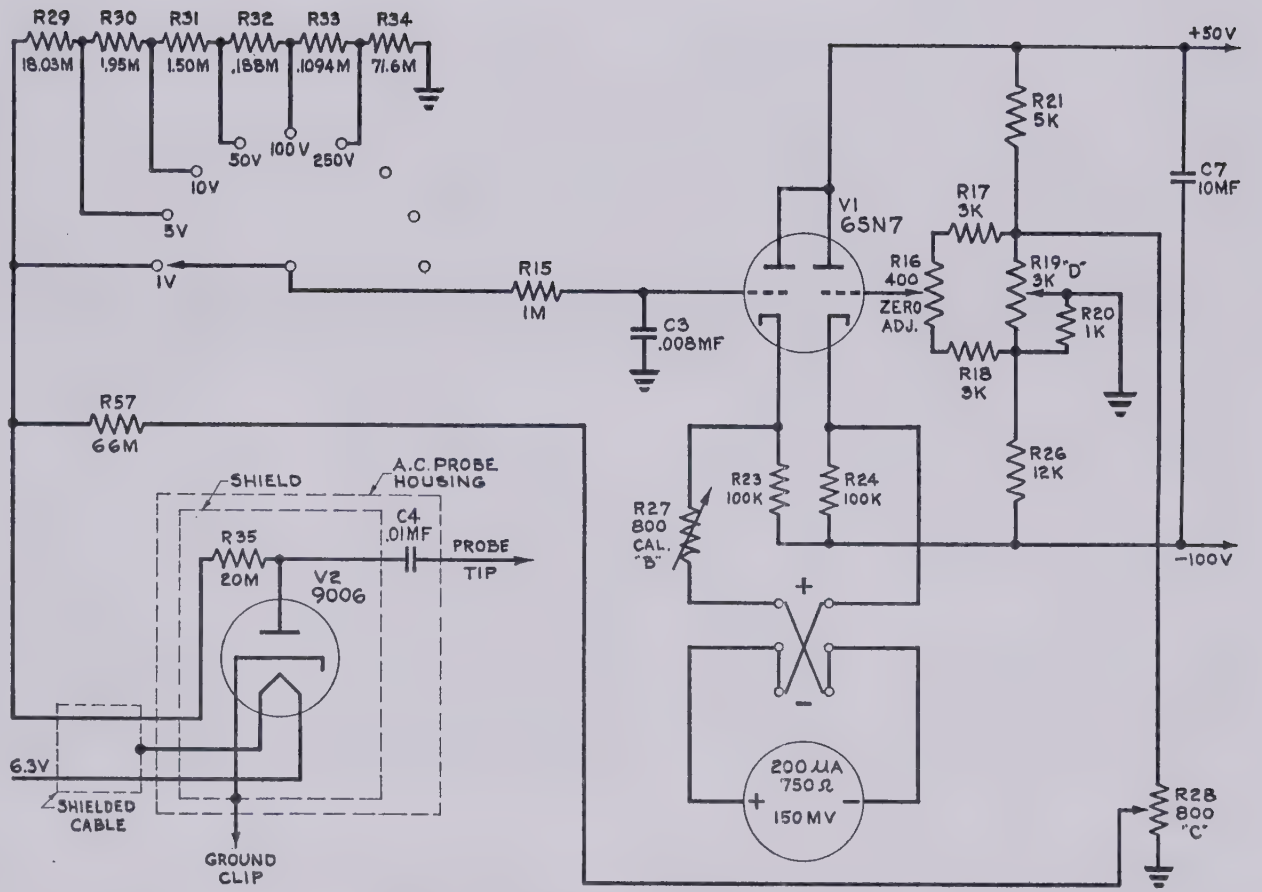


Figure 4 Simplified AC Voltmeter Circuit

Resistor R15 and condenser C3 provide additional filtering and isolation in the grid circuit.

A fixed negative bias is applied to the cathodes of tube V1 from the power supply through resistors R23 and R24 which provide a small amount of self bias.

The high value of R23 and R24 results in degeneration in the cathode circuits, providing stable operation and linearity.

The meter is connected between the two cathodes of tube V1. Potentiometer R19 is factory adjusted to balance the two sections of tube V1. With R16 (zero adjustment on panel) set at its center point, the voltages between the two cathodes will be equal and the meter will indicate zero.

With the circuit selector switch in the zero center position, resistor R26 is connected in parallel with resistor R24 thus causing a difference in voltage to appear between the two cathodes of tube V1. This causes the meter to indicate approximately zero on the zero center scale. The "ZERO ADJ" control R16 is then adjusted for the exact zero reading.

The variable resistor R22 (located on chassis and marked "A") is connected in series with the meter on all DC ranges and is factory adjusted to provide accuracy of calibration on all DC voltage ranges. When a voltage is applied to the DC probe, a proportionate voltage appears at the grid of the first section of the 6SN7 tube V1, causing different currents to flow in each half of V1. This results in a voltage difference between the two cathodes. This voltage difference is applied to the meter causing an indication in proportion to the voltage at the DC probe.

2. AC VOLTMETER

The simplified circuit of the Model 266 when used as an AC voltmeter for voltages under 250 is shown in Figure 4.

The AC probe contains the 9006 diode V2 which rectifies the AC voltage being measured. Condenser C4 is the DC blocking condenser. The rectified voltage is applied across the voltage divider consisting of resistors R35, R29, R30, R31, R32, R33, and R34. The operation of the balance of the circuit is the same as described under DC VOLTMETER.

To permit the zero adjustment to remain the same for both AC and DC ranges, the contact voltage developed in the 9006 tube must be overcome. This is accomplished by applying a small positive DC voltage from potentiometer R28 (located on chassis and marked "C") through resistors R57 and R35 to the plate of 9006 tube V2. This adjustment is made at the factory.

Voltages higher than 250 are checked by placing the AC probe in the probe well and using test leads connected to the "COMMON" and "AC VOLTS" or "5000 V AC" jacks, according to the voltage being checked. Under these conditions, the voltage under test is reduced by a voltage divider before being applied to the probe. This circuit is shown at the lower left corner in the Model 266 schematic, Figure 2.

The variable resistor R27 (located on chassis and marked "B") is connected in series with the meter on all AC voltage ranges and is factory adjusted to provide accuracy of calibration on all AC voltage ranges.

3. DC MILLIAMMETER AND AMMETER

Figure 5 shows the circuit used when the CIRCUIT SELECTOR switch is in the "DC MA AMPS" position and the RANGE SELECTOR switch is in one of the seven current measuring positions. The shunt resistors are arranged so that for full current in each range, a current of 200 microamperes flows through the meter, causing full scale deflection with the balance flowing through the shunt resistors.

The 10 AMP range is obtained through separate jacks of sufficient size to carry that amount of current and is independent of the setting of the RANGE SELECTOR switch although the CIRCUIT SELECTOR switch must be placed in the "DC MA AMPS" position.

The voltages appearing across the various sections of the shunt resistor at full current are shown opposite the current ranges, paragraph 2c, Section I.

It is not necessary to have the 266 plugged into the AC line when making current measurements.

4. OHMMETER

Figure 6 shows the circuit used when the circuit selector is in the "OHMS" position and the range selector in one of the resistance measuring positions.

A Mallory RMBZ4 1.34V battery is used to supply the potential. This potential (without resistor under test connected) applied to the grid of the first section of the 6SN7 tube V1 is sufficient to cause full scale deflection of the meter, accurately controlled by variable resistor R56 (marked "OHMS ADJ" on panel).

When the resistance under test is connected between the "COMMON" and "OHMS" jacks, a voltage divider circuit is produced consisting of the 1.34V battery in series with the standard resistor R45 to R51 and the resistor under test. The voltage across the unknown resistor is proportional to its resistance. This voltage is applied to the grid of the first section of tube V1 which produces a meter deflection proportional to the unknown resistance.

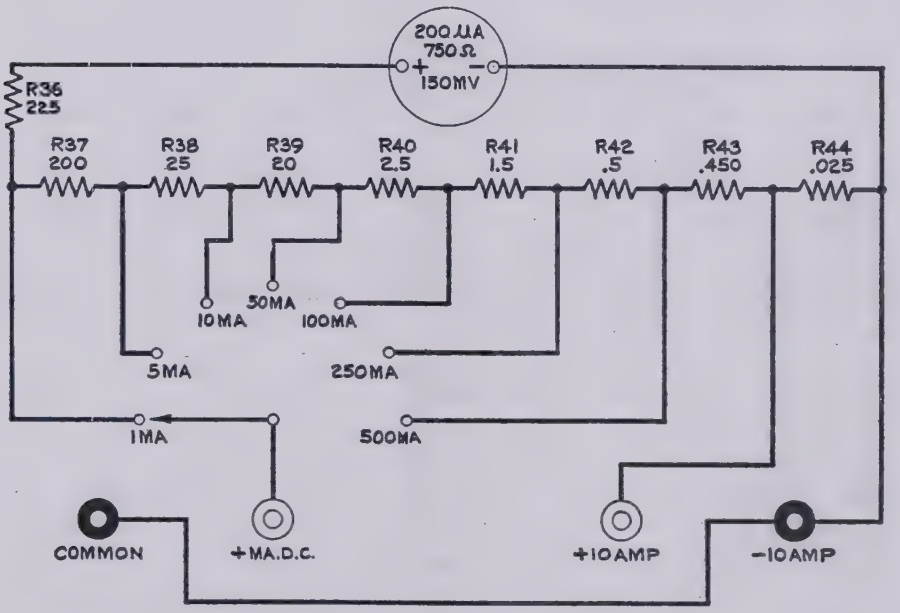


Figure 5 Simplified Milliammeter and Ammeter Circuit

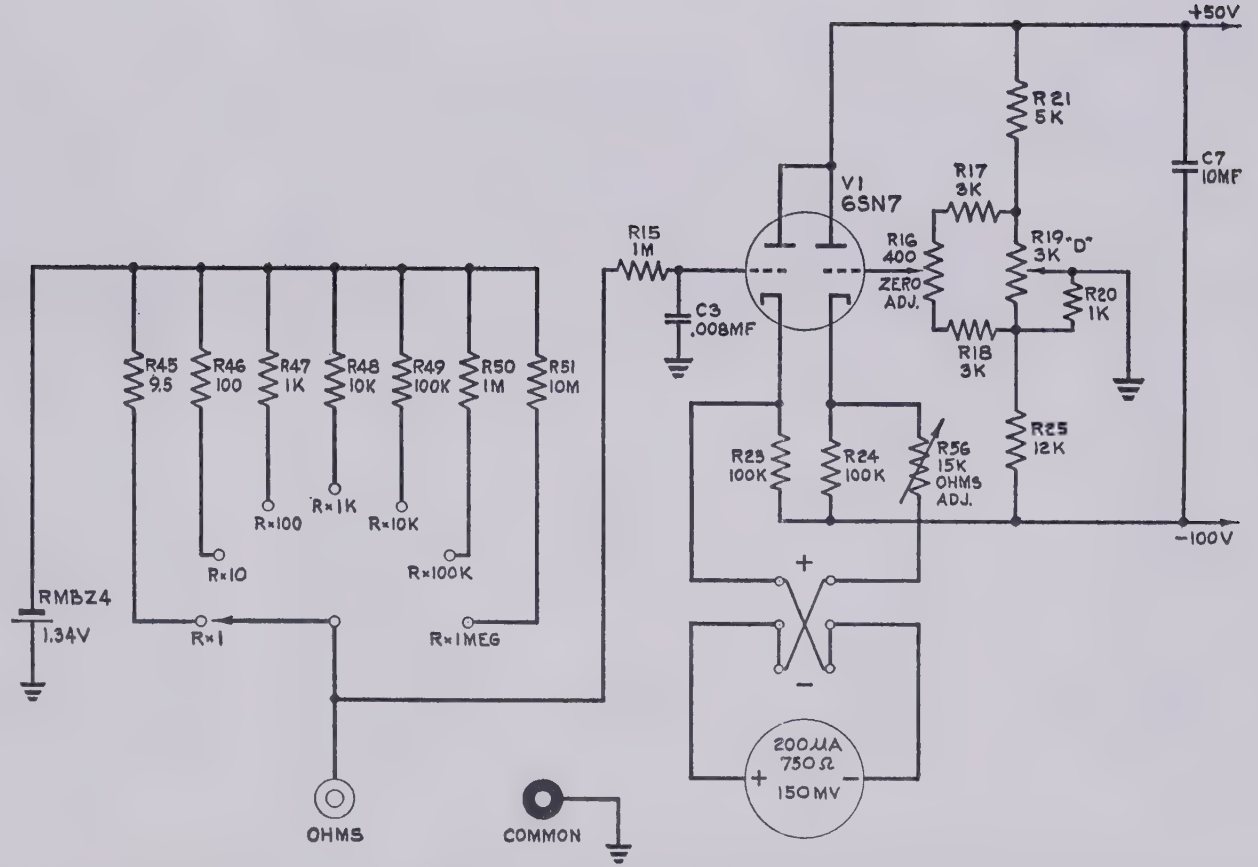


Figure 6 Simplified Ohmmeter Circuit

SECTION IV

APPLICATIONS

The high input resistance of the Model 266 permits its use in many applications where a voltmeter of lower sensitivity would cause excessive circuit loading. The following suggestions are only a few of the uses for which it will be found a superior instrument.

1. PLATE VOLTAGE MEASUREMENTS

Inaccurate readings of plate voltage often result when a low resistance voltmeter is used, especially in the case of high mu tubes which require high values of plate resistors. Such voltage can be accurately measured with the 266, its low current drain resulting in a true reading.

2. PHASE INVERTER BALANCE

The two sections of a phase inverter circuit may be checked for balance with the 266. With an audio signal generator connected to the input of the audio amplifier, the voltages at the grids and plates may be measured.

3. MEASUREMENT OF STAGE GAIN

The Model 266 is an ideal instrument for measuring stage gain. The output of the signal generator may be checked and the amplified signal then measured at the plate of the tube of the stage being tested. The ratio of the voltage at input and output of a stage represents the stage gain.

4. AVC VOLTAGE

The use of the Model 266 to measure AVC voltage is possible because the high input resistance of the 266 has very little loading effect on such a circuit. Connecting the 266 across the AVC network is often more convenient than using an output meter for alignment purposes as the volume control may be set at its minimum position and it is not necessary to disconnect the AVC to prevent it from interfering with the alignment procedure.

5. DISCRIMINATOR ADJUSTMENT

The zero center switch on the 266 permits easy adjustment of a discriminator stage. Connected across the load resistors, the reading will be zero when in balance but will deflect to the right or left if the stage is unbalanced.

6. FM ALIGNMENT

By connecting the 266 across the load resistor of the limiter, a reading may be obtained for alignment purposes. Adjust the circuits for maximum indication. Manufacturer's instructions should be followed for exact procedure.

7. GRID VOLTAGE

The high input resistance of the Model 266 makes it possible to measure voltage at the grids of tubes without excessive loading of the circuit. For example, the output of a local oscillator may be checked throughout the tuning range.

8. BIAS VOLTAGE

Bias voltages can be read accurately with the 266. Its input resistance is so high that when connected across a bias resistor, the additional current drain is negligible.

9. COUPLING AND BY-PASS CONDENSERS

Inasmuch as a condenser presents low impedance to AC current, readings may be taken on both sides of the condenser and should be approximately the same unless the condenser is defective.

10. SIGNAL TRACING

The Model 266 is very useful in signal tracing or examining a radio circuit at various points in audio or radio frequency circuits. Its low capacity AC probe permits it to be used on high frequencies found in FM and television work, while it is equally suitable for audio frequencies as low as 30 cycles.

SECTION V

MAINTENANCE

1. CARE

The Model 266 is a very rugged instrument designed to take the wear and tear of every day service work. Nevertheless, it should receive the care given to other fine electronic equipment and care should be used against dropping or other excessively rough treatment.

2. REPLACEMENT OF BATTERY

The RMBZ4 battery used as a current source for the ohmmeter section has an extremely long shelf life. It will give long service in the 266 but when replacement is necessary, a new battery can be slipped into the clamp holding the battery in place. It will be necessary to remove the 266 from its case which can be done by removing the four panel screws and the two in the bottom of the case. When inserting the battery, be certain that the polarity is correct. The case of this type battery is positive and the battery should be inserted so that the terminal fastened to the clamp makes contact with the case of the battery.

3. CALIBRATION

The Model 266 is carefully calibrated at the factory and no further changes should be necessary. However, in case re-calibration is required at any time, the following instructions should be observed.

Allow the 266 to warm up for approximately 1 hour. Plug the DC probe into the "COMMON" jack. Connect the AC probe and plug it into the probe well. Place the range selector switch in the 1V position.

Place the circuit selector switch in the "—DC" position. Turn the "ZERO ADJ" knob to the extreme right and note the reading on any scale. Turn the circuit selector switch to the "+DC" position and turn the "ZERO ADJ" knob to the extreme left. Note reading. Adjust potentiometer "D" (located on chassis inside of tester) until these two readings are approximately equal.

Place the circuit selector switch in either the "+DC" or "—DC" position. Adjust the "ZERO ADJ" knob so that the meter indicates zero. Place the circuit selector in the "ACV" position and adjust potentiometer "C" (located on chassis) until the meter indicates zero.

Place the circuit selector switch in either the "+DC" or "—DC" position and set the range selector switch to any convenient range. Apply a known DC voltage to the DC probe of corresponding polarity and within the limits of the range selected. Adjust potentiometer "A" (located on chassis) until the meter indication corresponds to the known calibrating voltage. For calibration at the factory a voltage is selected approximately equal to .8 of full scale.

Place the circuit selector switch in the "ACV" position and apply a known AC voltage to the AC probe. Adjust potentiometer "B" (located on chassis) until the meter indication corresponds to the known voltage.

4. REPLACEMENT OF TUBES

To replace the 9006 tube in the AC probe, remove the three small screws holding the front section to the cylindrical housing. Carefully separate the two sections, holding the 9006 tube socket while the housing is slipped up on the cable until the tube is exposed. Lift the terminal board away from the top of the tube and remove the 9006 tube while holding the socket in position. Clip off terminals 2, 5, and 6 of the new 9006 tube (to reduce capacitance) and insert tube in socket. Replace terminal board over the top of the tube. Re-assemble the probe housing, being certain that the clip attached to the ground terminal of the 9006 socket engages the eyelet to which the grounding clip is fastened. It may be necessary to bend the ears of this clip slightly to make certain of good connection. When assembling, turn the cable until the cable anchor slips into the notches inside of the housing. After replacement of the 9006 tube, re-calibration of the AC ranges may be necessary. The calibration may also change after the tube has aged unless the tube has been aged before using.

The 6x5 tube can be replaced when necessary without affecting the calibration.

When replacing the 6SN7 tube, it is advisable to use a tube which has been aged for 48 hours (connected in a circuit with a small amount of plate current flowing). A tube should be selected that will provide the best calibration for all ranges. This can be checked in the following manner. Place the circuit selector switch in the "—DC" position. Place the DC probe in the "COMMON" jack. Turn the range selector switch to the 1V position and set zero by means of the "ZERO ADJ" knob. Turn the range selector switch through all positions, noting any variation in the meter indication. This should not vary more than 2.5 divisions.

5. REPLACEMENT OF PARTS

If it becomes necessary to replace parts, they may be secured from the factory. When ordering, specify part numbers as shown in the following parts list.

PART No.	DESCRIPTION	REFERENCE SYMBOL
1-113433	Fixed resistor 5M	R1
1-113528	Fixed resistor 20M	R2
1-113528	Fixed resistor 20M	R3
1-113533	Fixed resistor 2.5M	R4
1-113534	Fixed resistor 2M	R5
1-113428	Fixed resistor 250K	R6
1-113366	Fixed resistor 150K	R7
1-113310	Fixed resistor 50K	R8
1-113426	Fixed resistor 25K	R9
1-113426	Fixed resistor 25K	R10
1-113353	Fixed resistor 80M	R11
1-113353	Fixed resistor 80M	R12
1-113525	Fixed resistor 40M	R13
1-113307	Fixed resistor 20K	R14
1-113431	Fixed resistor 1M	R15
1-113271	Potentiometer 400 ohms	R16
1-113287	Fixed resistor 3K	R17
1-113287	Fixed resistor 3K	R18
1-113194	Potentiometer 3K	R19
1-113542	Fixed resistor 1K	R20
1-113532	Fixed resistor 5K	R21
1-113193	Potentiometer 800 ohms	R22

PART No.	DESCRIPTION	REFERENCE SYMBOL
1-113427	Fixed resistor 100K	R23
1-113427	Fixed resistor 100K	R24
1-113531	Fixed resistor 12K	R25
1-113538	Fixed resistor 280K	R26
1-113193	Potentiometer 800 ohms	R27
1-113193	Potentiometer 800 ohms	R28
1-113529	Fixed resistor 18.03M	R29
1-113535	Fixed resistor 1.95M	R30
1-113536	Fixed resistor 1.5M	R31
1-113539	Fixed resistor 188K	R32
1-113540	Fixed resistor 109.4K	R33
1-113541	Fixed resistor 71.6K	R34
1-113202	Fixed resistor (series) 20M	R35
0-008286	Fixed resistor (bobbin) 225 ohms	R36
0-008280	Fixed resistor (bobbin) 200 ohms	R37
0-008282	Fixed resistor (bobbin) 25 ohms	R38
0-008076	Fixed resistor (bobbin) 20 ohms	R39
0-008284	Fixed resistor (bobbin) 2.5 ohms	R40
0-008258	Fixed resistor (bobbin) 1.5 ohms	R41
0-008053	Fixed resistor (bobbin) .5 ohms	R42
0-008296	Fixed resistor (bobbin) .45 ohms	R43
0-008035	Shunt assembly 10 amp 250 MV	R44
0-008283	Fixed resistor (bobbin) 9.5 ohms	R45
0-008281	Fixed resistor (bobbin) 100 ohms	R46
1-113542	Fixed resistor 1K	R47
1-113306	Fixed resistor 10K	R48
1-113427	Fixed resistor 100K	R49
1-113431	Fixed resistor 1M	R50
1-113530	Fixed resistor 10M	R51
1-113353	Fixed resistor 80M	R52
1-113526	Fixed resistor 38M	R53
1-113527	Fixed resistor 30M	R54
1-113537	Fixed resistor 336K	R55
1-113195	Potentiometer 15K	R56
1-113524	Fixed resistor 66M	R57
1-113198	Mica condenser .001 MF, 1200V	C1, C2
1-112686	Mica condenser .008 MF, 300V	C3
1-113199	Mica condenser .01 MF, 300V	C4
1-112969	Paper condenser .05 MF, 400V	C5, C6
1-113200	Electrolytic condenser 10MF, 150V	C7

PART No.	DESCRIPTION	REFERENCE SYMBOL
1-113006	Rotary switch, 9 position, 5 decks Range Selector	
1-113007	Rotary switch, 7 position, 3 decks Circuit Selector	
1-113233	Fuse 3AG ½ Amp.	
1-113196	2A12 ballast tube	
1-112481	Octal tube socket	
1-113232	7 pin miniature socket	
1-113235	Chassis connector (DC probe)	
1-113236	Chassis connector (AC probe)	
1-113237	Cable connector (AC probe)	
1-113238	Cable connector (DC probe)	
1-111122	Tip jack, black (COMMON)	
1-111123	Tip jack, red (AC Volts, Ohms, MA-DC)	
1-113244	Tip jack, red (5000V)	
1-113245	Tip jack, red (10 AMP)	
1-113246	Tip jack, black (10 AMP and probe well)	
0-008963	Complete AC probe assembly	
0-008420	Ground lead assembly for AC probe	
0-008964	Complete DC probe assembly	
0-006182	Case—machined and assembled	
3-230044	Panel-machined	
0-008375	Test lead set	
0-008955	Power transformer	
15-132266	Meter, Model 29, 200 UA, 750 ohms	
3-260027	Bar knob (Selector and range switch)	
1-111756	Knob, round (Zero adj. and zero ohms)	
1-113231	RMBZ 4 battery 1.34V	